

Original paper

## **EGG QUALITY CHARACTERISTICS IN AUTOCHTHONOUS GENOTYPES OF CHICKENS RAISED ON MACEDONIAN RURAL FARMS**

*Kocevski D.<sup>\*1</sup>, Bunevski G.<sup>1</sup>, Dzabirski V.<sup>1</sup>, Vukovic V.<sup>1</sup>, Porcu K.<sup>1</sup>, Nikolova N.<sup>2</sup>, Tanevski M.<sup>3</sup>, Tasev G.<sup>3</sup>*

<sup>1</sup>Institute for Animal Biotechnology, Faculty for Agricultural Science and Food, University "Ss Cyril and Methodius", Skopje, R.Macedonia

<sup>2</sup>Institute of Animal Science, University "Ss Cyril and Methodius", Skopje, R.Macedonia

<sup>3</sup>NGO SREBRA, Association of breeders of domestic village chickens – Skopje, R.Macedonia

\*Corresponding author: Dragoslav.Kocevski@yahoo.com

### **Abstract**

Egg quality characteristics of three different autochthonous chicken phenotypes (phenotype having ashy-silvery-brown leghorn laced plumage color, phenotype having light brown spangled plumage color and phenotype having black or blue plumage color) were examined. These types of chickens are mainly raised as backyard rural area flocks in the villages of R. Macedonia. The data were collected through first systematic approaches in phenotypical identification and characterisation of these autochthonous genotypes realized recently. Three small flocks of old hens collected from different villages and placed in control pens were established. No data about number of eggs/hen/year is available for the established flocks. Further investigations are needed to record productive (number of egg produced) and reproductive data. The plan was that additional, yearly production records be collected from the flock produced as offspring from established flock of old hens collected from different villages and placed in control pens. Set of 90 eggs was collected (30 eggs from each plumage phenotype) and basic egg quality parameters measured. Egg size (weight) was 50.71g for brown laced plumage phenotype, 60.48g for blue plumage phenotype and 52.6 g for light brown spangled plumage phenotype. Egg shell strength was 3965, 3628 and 3924 g/cm<sup>2</sup> for brown laced, blue and brown spangled plumage phenotype, respectively. Light brown spangled plumage phenotype had the highest value of yolk color (10.29) and Hough Units (76.63) compared to brown laced (10.08 and 75.27) and blue (9.09 and 71.65) plumage phenotype.

**Key words:** *autochthonous, egg quality, genotypes, poultry, rural*

### **Introduction**

Global trends have been oriented toward identification, characterization, protecting and conservation of the animal genetic resources worldwide. Chickens are part of these activities and contribute toward world's food security, safety and sustainability. Many reports have been published on the characteristics of different native genotypes of chickens in order to offer small, but valuable contribution to these global efforts for protecting the genetic poultry resources.

Tharrington et al. (1999), analyzing historical Leghorn strains conclude that genetic selection has resulted in decreased yolk percentage due to increased egg size, meaning that selection improved albumen size but the overall egg quality has been maintained. Zanon et al. (2006) in his study examined the egg characteristics of autochthonous Modenese and Romagnolo breeds and report light and small eggs produced by them but these eggs had higher contents of yolk protein than commercial eggs. General findings of the study of Krawczyk (2009) was that native breed hens kept for many years in closed populations where no selection process was practiced express noticeable differences in some egg quality traits that can change according to egg production level and layer age but not in a pattern noticed in the commercial hybrid hens selected for high production. Ceccobelli (2013) has summarized and described the most important traits for several breeds (Albanian, Serbian, Spanish and Italian) in PhD thesis focusing on molecular tools in analyzing genetic diversity of Mediterranean autochthonous chicken breeds.

Analysing data on the quality of eggs of different genotypes has shown a relatively poor quality of eggs laid by Naked Neck, namely, lower weight, lower quality and poorer inner shell quality. The difference in the quality of the eggs was also identified between autochthonous breeds (Pavlovski et al., 2012).

Macedonia is a small country in Balkan Peninsula with about two million inhabitants in which rural population represents 41% of these two million. Poultry industry officially records about 2.2 million chickens, with three level tiers structure. Egg production covers domestic market demands but poultry meat production covers only 4-5% of the market needs. Overall average egg production at all three levels is 152 eggs/hen/year. First level of production is organized on 10-15 big enterprise farms with average capacity 80-100000 layers where around 1 million layers are kept in cages reaching production level of over 310 eggs/year. Second level is represented by medium and small family owned farms covering 200 000 layers. Third level comprises all other (around one million) chickens that are backyard poultry with average production of 80-100 eggs/hen/year kept for the household needs. In the third level many fancy breeders exist that keep different breeds rarely taking in consideration breeding structure and keeping herdbooks for pedigree breeding purposes (Ministry of Agriculture, Forestry and Water Economy (MAFWE), 2007; 2008). At the moment no national livestock gene bank is established in the country (Ministry of Agriculture, Forestry and Water Economy (MAFWE), 2010). Such gene bank could serve as a main point for conservation, protection, monitoring and inventory of livestock biodiversity. First systematic activities were realized in 2011, aiming to monitor the happenings in the “third (rural) level” of poultry industry. The idea was to investigate if there are remains of archaic, native or indigenous genotype of chickens that used to be there before the era of industrial poultry production. These efforts were part of the state goals toward protection and conservation of the genetic diversity in the area of domestic animals and poultry according to the acquired obligation stated in the “Law for Livestock”. Additionally, noticeable efforts are made through different international organisations for protecting and conservation of the genetic resources in agriculture in general and poultry species as a part of it. Activities in this direction could help establishing protected flocks of rare breeds and genotypes that exist among rural areas in the country. The information presented is the result of these and follow-up, ongoing activities in the area of preservation of the indigenous chicken genotypes.

## **Material and methods**

Recently, three small flocks of old hens collected from different villages and placed in control pens have been established through the support obtained from GEF project enabling first systematic approaches in phenotypical identification and characterisation of these autochthonous genotypes. The eggs were collected from these pens (pen of hens having ashy-silvery-brown leghorn laced plumage color, pen of hens having light brown spangled plumage color and pen of hens having black or blue plumage color). Set of 30 eggs from each plumage phenotype was collected and basic egg quality parameters measured. No data about number of eggs/hen/year are available for the established flocks. Analyses of the external (egg mass - g, egg shell strength - g/cm<sup>2</sup>) and internal (yolk color – La Roche ladder 1-15, albumen quality – Hough units) egg quality parameters were performed in the laboratory for control of the marketing quality of eggs in the Institute for Animal Biotechnology of the Faculty of Agricultural Sciences and Food using automated machine Egg multi tester EMT 5200, for measuring the internal quality and Eggshell Force Gauge for measuring the egg strength (Robotmation Co. Ltd., Tokyo, Japan).

## **Results and discussion**

### **Morphological characteristics**

Using the Generic data collection format for phenotypic characterization of chickens from Annex 3 of the Draft guidelines on phenotypic characterization, determined by Intergovernmental technical working group on animal genetic resources for food and agriculture of the Commission on genetic resources for food and agriculture of FAO (2012), three distinct phenotypes were determined and small flocks of hens with similar phenotype were established for further reproduction and monitoring:

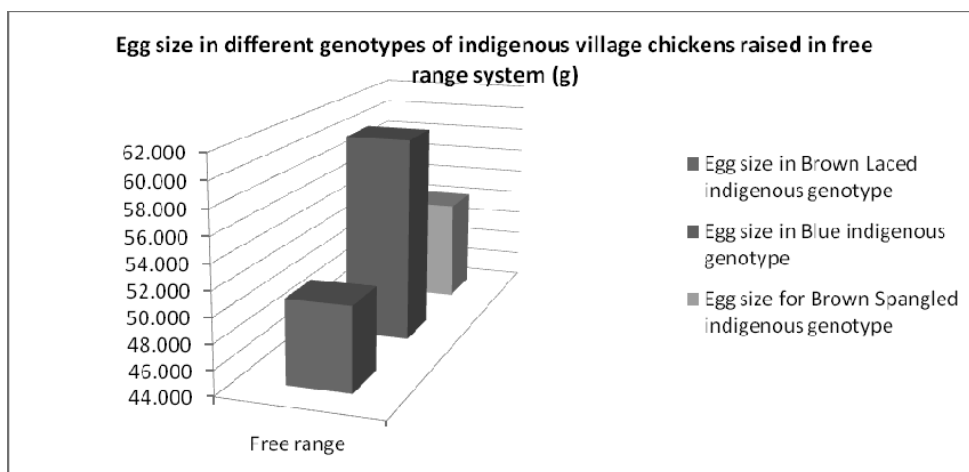
- Phenotype having ashy-silvery-brown leghorn laced plumage color;
- Phenotype having light brown spangled plumage color and
- Phenotype having black or blue plumage color.

### **Egg quality characteristics**

**Table 1.** *Egg quality characteristics of different indigenous genotypes raised in village area of Macedonia as backyard chickens*

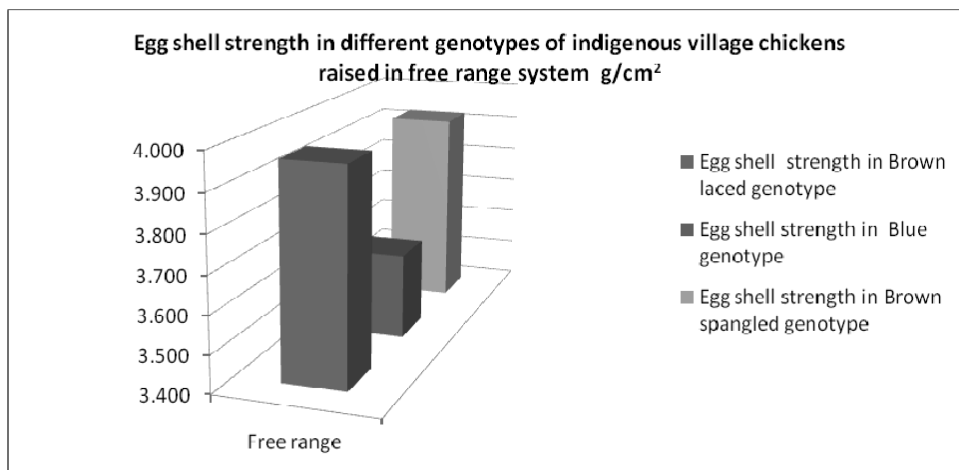
Parameters	Brown laced	Blue	Brown spangled	Average
Egg weight (g)	50.71	60.48	52.26	54.48
Egg shell strength g/cm <sup>2</sup>	3965	3628	3924	3839
Yolk color – La Roche points (1-15)	10.08	9.09	10.29	9.82
Internal quality - albumen quality (Hough Units)	75.27	71.65	76.63	74.52

Egg production level is still not recorded, but the plan is to establish a control flock from each of the phenotypes in the next year and to follow their productivity for the year. Estimates are that 100-120 eggs are laid yearly in all three varieties but it hardly depends on the feed used and feeding practice. Sample of 30 eggs from each of the flocks of all three phenotypes was included in this analysis. Results (Table 1.) present average values for egg size (weight) and other egg characteristics (shell strength, yolk color and Hough units). Egg weight was 50.71g, 60.48g and 52.6g for brown laced plumage phenotype, blue plumage phenotype and brown spangled plumage phenotype, respectively. Eggshell strength figures were 3965, 3628 and 3924, and yolk color 10.08, 9.09 and 10.29 for brown laced plumage phenotype, blue plumage phenotype and brown spangled plumage phenotype, respectively. Hens from brown spangled plumage phenotype produce eggs with best albumen quality (76.63 Hough Units) in comparison with brown laced plumage (75.27) and blue plumage phenotype (71.65).



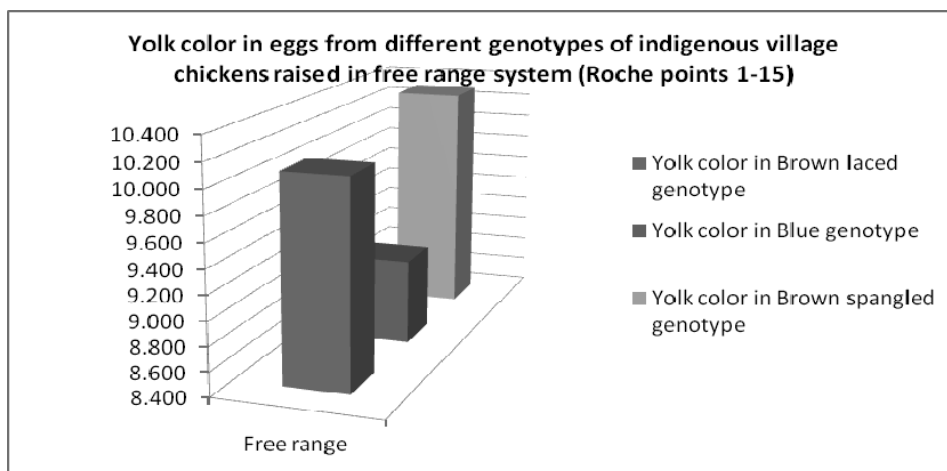
**Graph 1.** *Egg size of different indigenous genotypes raised in village area of Macedonia as backyard chickens*

The average egg size (Graph 1) was quite high (54.48 g) compared to some other results of research on indigenous eggs. The indigenous eggs are mostly small in size with less weight when compared with other types of chicken eggs (Shabbir et al., 2013). The larger size of eggs especially in the Blue genotype was due also to the greater age of the chickens. The eggs mass increased with the age of hens, especially from traditional production where egg mass showed continuous increase with the age of hens (Škrbić et al., 2011).



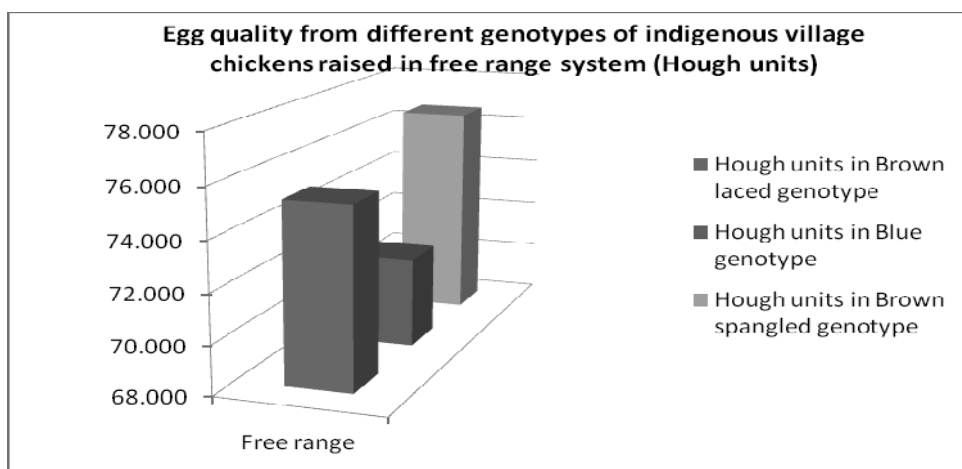
**Graph 2.** Egg shell strength in different indigenous genotypes raised in village area of Macedonia as backyard chickens

Egg shell strength (Graph 2) was 3839 g/cm<sup>2</sup> on average which is a good strength of shell especially in Brown laced genotype that had the smallest mass of eggs and also the best strength of the shell, which indicates a positive correlation between the two parameters. Significant ( $P < 0.05$ ) negative correlation was found between egg shell strength and egg weight (-0.175) indicating that with increasing the egg weight the eggshell strength decreases (Kocevski et al., 2011).



**Graph 3.** Yolk color in different indigenous genotypes raised in village area of Macedonia as backyard chickens

Yolk color (Graph 3) was very good, ranging from 9.09 to 10.29 points in La Roche scale, showing that the trait can be considerably improved when hens are given access to green outdoor areas. Free-range layers consumed plants that were a source of xanthophylls for egg yolk. Van den Brand et al. (2004) and Horsted et al. (2006) observed that plants consumed on free-range have a beneficial effect on yolk color.



**Graph 4.** *Internal (albumen) quality (Hough Units) in different indigenous genotypes raised in village area of Macedonia as backyard chickens*

The value of Hough units (Graph 4) showed good quality of egg albumen and high freshness, 74.52 average for all genotypes. Eggs from backyard system received the best scores for freshness (albumen height and Haugh units), corroborating the results of similar studies by Kosmidou et al. (2007), Sekeroglu et al. (2008) and Krawczyk (2009). Meanwhile, Rossi (2007) obtained lower Haugh units for the eggs of hens kept under organic production systems compared to caged layers.

## Conclusion

Full system for monitoring and recording the local breeds is at the beginning, therefore monitoring of trends and risks in the field of endangered local breeds are scarce. This means that these, first information are indicative and based on scientific research activities and first systematic efforts realized recently.

Presented egg characteristics of the three chicken phenotypes described belong to one "Macedonian" genotype, which is part of the mixed gene pool that exists among village chicken population in Macedonia. Further activities are needed in realization of the conservation program toward stabilization of the phenotypic population and collection of morphometrical, productive and reproductive data for the existing flocks. This will contribute toward definition and characterization of breed or genotype standards for the exterior including body measures, phenotypical, biological, productive and reproductive characteristics.

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